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FOREST PEST MANAGEMENT
Pacific Southwest Region

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A BIOLOGICAL EVALUATION OF EXISTING AND POTENTIAL FOREST INSECT AND DISEASE PROBLEMS IN COUNCIL CAMP, LOBO-OSO GROUP CAMP, AND SMOG-THINNING STUDY PLOTS, SAN BERNARDINO NATIONAL FOREST

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ABSTRACT

Three different situations were evaluated on the San Bernardino National Forest. Plots which were established to assess the effects of thinning on smog damage were examined for pest problems which could influence the study. No major problems were detected in any of the 3 thinning or control plots examined. Two group campgrounds were evaluated to provide pest management input to silvicultural prescriptions for the areas. The major problems seen at Council Camp were Fomes annosus, Elytroderma deformans and pocket gophers. At the Lobo-Oso Group Camp, both Fomes annosus and dwarf mistletoe were widespread and seriously impacting the vegetation. Minor problems at the Lobo-Oso Camp were true mistletoe in the black oak, dead and hazardous trees and the Jeffrey pine beetle. Maps showing the location of the major pest problems were prepared.

INTRODUCTION

On June 1 and 2, 1981, James Allison and Dave Schultz from the Forest Pest Management Staff examined three different situations on the San Bernardino National Forest. Two of the situations were group campgrounds on the San Gorgonio Ranger District for which silvicultural prescriptions will be prepared. Also examined were three study plots being established to assess the effects of thinning on smog damage.

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OBERVATIONS

Smog thinning plots. Plot 1 consisted mainly of pole-size trees in the pine type which is located near the Barton Flats campground. There is apparently no root disease or dwarf mistletoe in the plots which would interfere with the study.

Plot 2 is located in the mixed conifer type near Angelus Oaks. A total of 5 trees, 4 in the plot to be thinned and 1 in the control plot, might influence the interpretation of the data. As shown on the enclosed map, one of the white fir in the control plot is losing a lot of needles for no apparent reason. Although there is no external evidence of pests attacking this tree, it might reasonably be expected to die within the near future. The leave trees marked in the plot to be thinned appear to be representative of the area; however, a few of the trees may not show a large response to thinning. Several of the white fir leave trees are 30+ inches dbh, at least one of the white fir has a minor amount of true mistletoe, one pole-size pine has the top snapped out and one pine has 25% or more of the branches infected with Elytroderma deformans. None of these conditions should seriously affect the outcome of the study, but they might be considered in the final evaluation.

Plot 3 is located in the mixed conifer type near the Sky Forest Station. Thinning was already completed by the time the plot was inspected. There was no dwarf mistletoe or root disease within, or immediately adjacent to, either the thinned or control plot. The only potential pest problems appeared to be the large amount of green slash still present in the thinned plot. At the time of the inspection, pine engravers, Ips spp., were just beginning to infest the pine slash.

Council Camp. Council Camp is a small group campground located at an elevation of 6500 ft. on a bench between Route 38 and the Santa Ana River canyon. The native trees present consisted primarily of Jeffrey pine with a few white fir and California black oak. Some juniper and a Sierra redwood have been planted near the toilet building.

The major problems encountered in the campground were several large Fomes annosus root disease centers, extensive Elytroderma disease in the Jeffrey pine and a high population of pocket gophers. In several areas not currently affected by annosus root disease the basal area is about twice the level that can be supported over long periods of time without pest-associated tree mortality. Western dwarf mistletoe is apparently not present in the campground. The location of the pest problems in the campground is shown on the attached map.

BIOLOGY OF PEST ORGANISMS

ANNOSUS ROOT DISEASE

Fomes annosus is a root-rotting fungus that attacks a wide range of woody plants, causing a decay of wood and death of sapwood and cambium. All conifer species in California are susceptible to the fungus. Hardwood species

are rarely damaged or killed; but madrone, Arbutus menziesii, and a few brush species including manzanita, Arctostaphylos spp., and sagebrush, Artemisia tridentata, are attacked.

During favorable periods, the fungus forms fruiting bodies in decayed stumps, under the bark of dead trees, or in the duff at the root collar. The fungus becomes established in freshly cut stumps from air-borne spores produced by the conks, and then grows into the root system. The fungus subsequently spreads to healthy roots of surrounding susceptible tree species via root contacts. Local spead of the fungus outward from a stump typically results in the formation of disease centers with dead trees in the center and fading trees on the margin. These centers usually continue to enlarge until they reach barriers such as openings or groups of non-susceptible plants.

The fungus may remain alive for as long as 50 years as a saprophyte in infected roots and stumps. Young susceptible tree species often become infected and die after their roots contact old infected root systems in the soil.

Trees in the families Taxodiaceae and Cupressaceae often survive for many years after infection by Fomes annosus because there aren't any aggressive bark beetles that will attack these trees before they are almost dead. As a consequence, the fungus can rot most of the structural roots while the top remains relatively green. If trees such as incense-cedar, juniper or Sierra redwood are planted in, or occur naturally in an annosus root disease center in a recreation area, a hazardous situation can develop. Green trees in these two families have lost enough root strength due to F. annosus infection to cause failure in trees which showed only subtle changes in the tree crowns.

ELYTRODERMA DISEASE

Elytroderma disease is caused by Elytroderma deformans, a fungus which infects mainly Jeffrey and ponderosa pines. It has also been reported on knobcone, lodgepole, and pinyon pines. The disease is spread by spores which are dispersed from small fruiting bodies produced on infected needles. After the spores infect current year's needles, the fungus becomes systemic in twigs. This perennial twig infection serves to reinfect each year's needles as they grow out and causes them to die and drop off the second year. Infected twigs retain only the current year's needles. The systemic infections also produce "witches' brooms" similar in appearance to witches brooms produced by dwarf mistletoes, except they tend to be more compact and globose, and the ends of the twigs turn up.

The disease may cause significant growth loss when more than 40% of the crown is infected. The impact of the disease can be reduced by removing trees with more than 40% of the crown infected and by favoring resistant species. Although direct killing of mature trees is infrequent, moderate to severe infection weakens trees and predisposes them to other diseases and to bark beetle attack. In areas where infection is generally light, pruning of brooms may restore the vigor of weakened trees.

MANAGEMENT OPTIONS FOR COUNCIL CAMP

1. No change in present management. Fomes annosus will persist in the infected stumps and roots until the wood has been completely rotted. Trees on the edge of active annosus centers will become infected and will probably die after being attacked by bark beetles. Conifers planted in the infection centers will become infected and die as their roots reach old infected roots and stumps, and the fungus will be perpetuated in the area. Junipers and Sierra redwood near the toilet building may become infected with Fomes annosus and become hazardous. Tree aggregations with high basal areas will have a high probability of being attacked by bark beetles or engraver beetles during periods of low precipitation. Elytroderma disease will slowly intensify and predispose a few pines to bark beetle attack. Conifers will compete with some of the existing oak trees, resulting in a reduction of oak vigor and growth.

2. Reduce impact of Fomes annosus. Once annosus root disease is established in a stand, no direct procedure is available for controlling it. Control, therefore, involves prevention of new centers by decreasing the risk of stump infection, and silvicultural manipulation of infected stands to minimize the effects of the disease. The following alternatives are available:

a. Prevent stump infection. Application of granular borax to freshly cut stumps is effective in preventing most (90%) new infections. The chemical is toxic to the spores of F. annosus, but has no effect on existing infections. Borax application is required on all stumps cut in and near developed recreation sites (FSM R-5 Supp. 2305 and 2331.33). Application requires the submission of a Pesticide Use Proposal.

b. Plant hardwoods. Revegetation of active annosus centers should be done only with resistant species. All conifers are susceptible to the fungus. Leaving the centers barren or planting them with resistant hardwoods will result in the fungus eventually dying out so that conifers can again be regenerated. Unfortunately, this will likely take 50 or more years.

Favoring the hardwoods already present and planting other suitable hardwoods will provide shade as well as establish a barrier of non-susceptible roots which may limit the spread of the infection centers. There will probably be fewer problems in maintaining the plantings if the trees or shrubs are transplanted or grown from seed collected near the campgrounds.

c. Remove conifers near toilet. The junipers and Sierra redwood near the toilet building are susceptible to Fomes annosus and are surrounded by root disease centers. These trees are likely to undergo a major loss of structural roots before showing many symptoms of infection. The Sierra redwood could reach a large enough size to do considerable damage if it isn't removed within the next decade.

3. Thin dense aggregations. Thinning the dense aggregations on the west edge of the campground and the pine thicket east of the toilet building would increase individual tree vigor and reduce the risk of attacks by bark beetles or engraver beetles. Thinning would eventually

reduce the opportunities for root contact and would consequently aid in preventing the underground spread of Fomes annosus. Stumps created during thinning must be treated with borax to prevent Fomes annosus infection, and slash should be treated - such as by chipping, burning or removing from the site-to minimize pine engraver buildups.

4. Reduce impact of Elytroderma disease. All of the twig distortion and brooming as well as some of the reduced needle retention of the pines near the parking area is apparently due to Elytroderma disease. If any thinning is done in the campground, the least infected trees should be favored for retention. The few trees which have large witches' brooms can probably be increased in vigor by pruning the brooms.

5. Control rodents. The open areas of the campground show evidence of a high gopher or other burrowing rodent population. Without rodent control, planting those area with anything but the largest stock is likely to be a futile effort.

6. Integrate treatments. Management alternatives 2 through 5 can be used alone or in combination to produce the desired result in various parts of the campground.

LOBO-OSO GROUP CAMPGROUND OBSERVATIONS

The Lobo-Oso Camp is located about a mile east of the Council Camp. The tree cover consists primarily of Jeffrey pine and black oak with minor amounts of white fir and western juniper.

Dwarf mistletoe was so extensive in the Jeffrey pine in the campground that no attempt was made to map the infections. Trees of all sizes were infected with dwarf mistletoe and many of the infections would be rated 5 or 6 on the Hawksworth scale. Opportunities for dwarf mistletoe control exist in the campground, but they would have to be applied on an individual tree or small aggregation basis.

A second major problem in the campground is the occurrence of a large number of Fomes annosus root disease centers. Other less extensive problems included true mistletoe in the black oak, dead and hazardous trees and one pine currently under attack by the Jeffrey pine beetle. Specific locations of the problems are indicated on the enclosed map.

BIOLOGY OF PEST ORGANISMS

ANNOSUS ROOT DISEASE. Discussed in section on Council Camp.

WESTERN DWARF MISTLETOE

Western dwarf mistletoe, Arceuthobium campylopodum, infects Jeffrey, ponderosa, knobcone, and Coulter pines. Other conifers or hardwoods are not infected by this particular species. Dwarf mistletoes are obligate parasites that are completely dependent on their host for support, water, and

most of their mineral and organic nutrients. They often cause the formation of "witches' brooms", or dense masses of distorted branches, on the host that divert nutrients from the rest of the tree. Infection can cause growth reduction, abnormalities, mortality and predisposition to attack by other pests. In particular, infected trees appear to be more susceptible to attack by bark beetles and the California flatheaded borer than do uninfected trees. The dwarf mistletoe/bark beetle complex is responsible for 40 to 60% of the pine mortality in southern California during years of normal precipitation. Mortality is more frequent when other stress factors are present, such as drought, poor site, oxidant air pollution damage, or competition in overstocked stands.

Dwarf mistletoe spreads between trees and within crowns of trees by means of small seeds that are forcibly ejected into the air. Spread from overstory to understory is limited To the distance the seeds are shot, generally 20 to 60 feet, but as much as 100 feet if assisted by wind or on steep slopes. Dwarf mistletoe spreads upward in pines at an average rate of 4 inches per year.

TRUE MISTLETOE

The true mistletoes are usually considered to be curiosities, but they can be serious pests where individual trees are of high value. Species of Phoradendron are especially "water parasites" and are less demanding of their hosts than the dwarf mistletoe.

True mistletoe infections are spread mainly by birds -- including robins, blue-birds, thrushes, and cedar waxwings -- that feed on the berries. Birds digest the pulp of the berries and excrete the living seeds, often depositing them onto susceptible trees. A viscous coating and hair-like threads on the outer surface of the seeds enables them to become firmly attached to twigs and branches, where they germinate and infect the host tissues.

Young or small trees are seldom infected by leafy mistletoe. In nearly all cases, initial infection occurs on larger or older trees because birds prefer to perch in their tops. Severe buildup of mistletoe often occurs in an already-infected tree because birds are attracted to and may spend prolonged periods feeding on the mistletoe berries.

Trees heavily infected by true mistletoe are weakened, reduced in growth rate, and sometimes killed. Weakened trees are predisposed to attacks by insects and often die during drought or other periods of stress. Individual oak limbs which are heavily infected with true mistletoe may die during periods of moisture deficiency. A reduced growth rate as a result of a heavy true mistletoe infection can cause slow wound healing which leads to infection by decay fungi and hazardous trees. Branches and tree tops heavily laden with true mistletoe often break during wind storms, and trunk swellings may provide an entrance point for decay fungi, increasing the hazard to people and property in campgrounds and other developed sites.

JEFFREY PINE BEETLE

The Jeffrey pine beetle, Dendroctonus jeffreyi, attacks only Jeffrey pine. There is one generation per year, with adults attacking trees from late March through October. Only the bole of the tree is attacked, and the beetle does not breed in the branches or slash. The Jeffrey pine beetle normally attacks scattered individual trees which are predisposed by such things as overmaturity, lightning strike, root disease or extremely heavy infections of dwarf mistletoe or Elytroderma disease. This beetle has an aggregating pheromone which serves to attract other Jeffrey pine beetles into the area of a tree under attack. Once the beetles are near the initial tree under attack, they may be able to overcome other healthy trees by their sheer numbers.

In years of adequate precipitation, mortality due to the Jeffrey pine beetle usually occurs as single trees or several trees growing close to each other. When precipitation is below normal, the Jeffrey pine beetle can kill larger groups of trees, including some apparently healthy trees.

Jeffrey pine in the campground which are currently in, or on the edge of annosus centers will probably become infected with root disease and will be attacked by the Jeffrey pine beetle. Pine mortality outside infection centers can be kept at a low level by measures designed to maintain or increase vigor of the trees. Pruning large dwarf mistletoe brooms from overstory trees and thinning younger stands that are infected will increase tree vigor and make them more resistant to bark beetles. Reducing the total basal area to 150 sq. ft./ac., or less where grass or brush is present, will probably result in less bark beetle-caused mortality during future periods of reduced precipitation. Rapid destruction or disposal of fresh pine slash will prevent the buildup of pine engravers, Ips spp., that otherwise cause top killing and predispose trees to the Jeffrey pine beetle. Vehicular traffic, construction and paving can be routed away from trees and their root zones to avoid wounding and root compaction that will predispose the trees to bark beetle attack.

MANAGEMENT OPTIONS FOR LOBO-OSO GROUP CAMPGROUND

1. No change in present management. Fomes annosus will persist in the infected stumps and roots until the wood has been completely rotted. Trees on the edge of active annosus centers will become infected and will probably die after being attacked by bark beetles. Conifers planted in the infection centers will become infected and die as their roots reach old infected roots and stumps, and the fungus will be perpetuated in the area. Dense thickets of young pines will probably be attacked by bark beetles or engraver beetles when precipitation drops below normal. Dwarf mistletoe will continue to spread and intensify in the campground. Bark beetles will probably kill the trees with Hawksworth ratings of 5 or 6 within the next 10-15 years. Conifers will compete with some of the existing oak trees, resulting in a reduction of oak vigor and growth. That will slow wound healing, promoting heart rot and increasing the rate of branch and tree failures: tree hazards.

2. Manage the Lobo-Oso area for uses other than a campground. Because the area has widespread and relatively persistent problems, it would require less input of time, money and other resources to manage the area for uses in which retention of the existing vegetation is a low priority. The relatively flat topography and easy access make the area suitable for fuel wood cutting, off-road vehicle use or organized team sports fields. Future pest problems in the remaining vegetation would be similar to those listed for Option 1.

3. Reduce impact of Fomes annosus. Annosus root disease is already present in a number of areas in the campground. There is currently no proven method of eliminating established disease centers. The impact of annosus root disease in the campground can be reduced by preventing the establishment of new centers and silviculturally treating infected stands to minimize the effects of the disease.

a. Prevent stump infection. Application of granular borax to freshly cut stumps is effective in preventing most (90%) new infections. The chemical is toxic to the spores of F. annosus, but has no effect on existing infections. Borax application is required on all stumps cut in and near developed recreation sites (FSM R-5 Supp. 2305 and 2331.33). Application requires the submission of a Pesticide Use Proposal.

b. Plant hardwoods. All conifers are susceptible to annosus root disease but most hardwoods are resistant. Leaving the centers barren or planting them with resistant hardwoods will result in the fungus eventually dying out so that conifers can again be regenerated. Unfortunately, this will likely take 50 or more years.

Favoring the hardwoods already present and planting other suitable hardwoods will provide shade as well as establish a barrier of nonsusceptible roots which may limit the spread of the infection centers. The use of stock from the same California Seed Zone as the campground may be important in the long-term maintenance of the plantings.

4. Thin areas with high basal areas. Reducing the total basal area to 120-150 square feet will aid in the control of several pest problems in the campground. Thinning dense stands of conifers will minimize opportunities for root contact and subsequent spread of Fomes annosus. Thinning of stands which are infected with dwarf mistletoe will remove an additional stress on the trees and increase their lifespan. In areas which are currently free from diseases, the major effect of reducing the basal area would be to increase tree vigor and reduce the risk of attack by bark beetles. Stumps created during thinning must be treated with borax, and slash should be treated to minimize pine engraver buildups.

5. Increase vigor of existing hardwoods. Some of the oaks in the campground are showing the effects of competition and shading from the surrounding pines, wounding and true mistletoe infections. The competition and shading have resulted in some oaks having dead branches, slow growth and slow wound healing. Thinning pines around oak trees would extend the useful life span of the oaks and may reduce the likelihood of tree failure. Conifer stumps should be treated with borax and the slash should be treated to minimize pine engraver buildups.

Some of the oaks may respond favorably to light fertilization and watering. Careful pruning of dead and dying branches would promote rapid healing and reduce the likelihood of tree failures.

Control of true mistletoe on the oaks would remove a source of competition for water, particularly during periods of low precipitation. Several options for the control of true mistletoe on individual high-value trees are available.

a. Prune. Prune infected limbs one foot or more below the point of mistletoe attachment, preferably at the bole.

b. Wrap infected branches. Cut off the shoots flush with the limb or bole. Wrap the affected area with a band of black polyethylene to exclude light and tie in place. Since the mistletoe will not survive without light, it may die within a year or two. If the area is not wrapped with plastic, new shoots will develop. Removing new shoots each year will restrict mistletoe development, but will not kill it.

6. Reduce impact of dwarf mistletoe. Several alternatives for reducing the impact of dwarf mistletoe in recreation sites are available. FPM funding may be available for approved dwarf mistletoe control projects. It should be kept in mind that even if efforts to control dwarf mistletoe are successful, the trees will likely die from root rot and subsequent beetle attack if they are within active annosus centers.

a. Broom pruning. The campground has trees which would benefit from broom pruning. High-value trees can be pruned of large brooms in the lower crown if, after removal of the brooms, the trees will have live crown ratios of 30% or more. Removal of brooms would increase the vigor of the trees and extend their life.

b. Thinning of even-aged stands. Thinning of infected stands will maintain optimum growth of the residuals and reduce stress. Mistletoe-infected trees should be selected against. The removal of all trees with Hawksworth dwarf mistletoe rating of 5 or 6 should be considered because these trees will likely die within the next 10-year period, most likely during the next drought. Treat all freshly cut stumps with borax to prevent invasion of F. annosus.

c. Remove infected overstory trees. Removal of infected overstory trees will eliminate a source of infection for surrounding understory trees. The remaining understory can then be thinned and/or pruned to eliminate dwarf mistletoe infections.

7. Integrate treatments. Management alternatives 3 through 6 are not mutally exclusive. They can be used alone or in combination in various parts of the campground to produce the desired results. Consideration of

the interactions among all insect and disease problems present will result in a successful integration of pest management strategies.

For clarification or additional information contact the Forest Pest Management Staff.

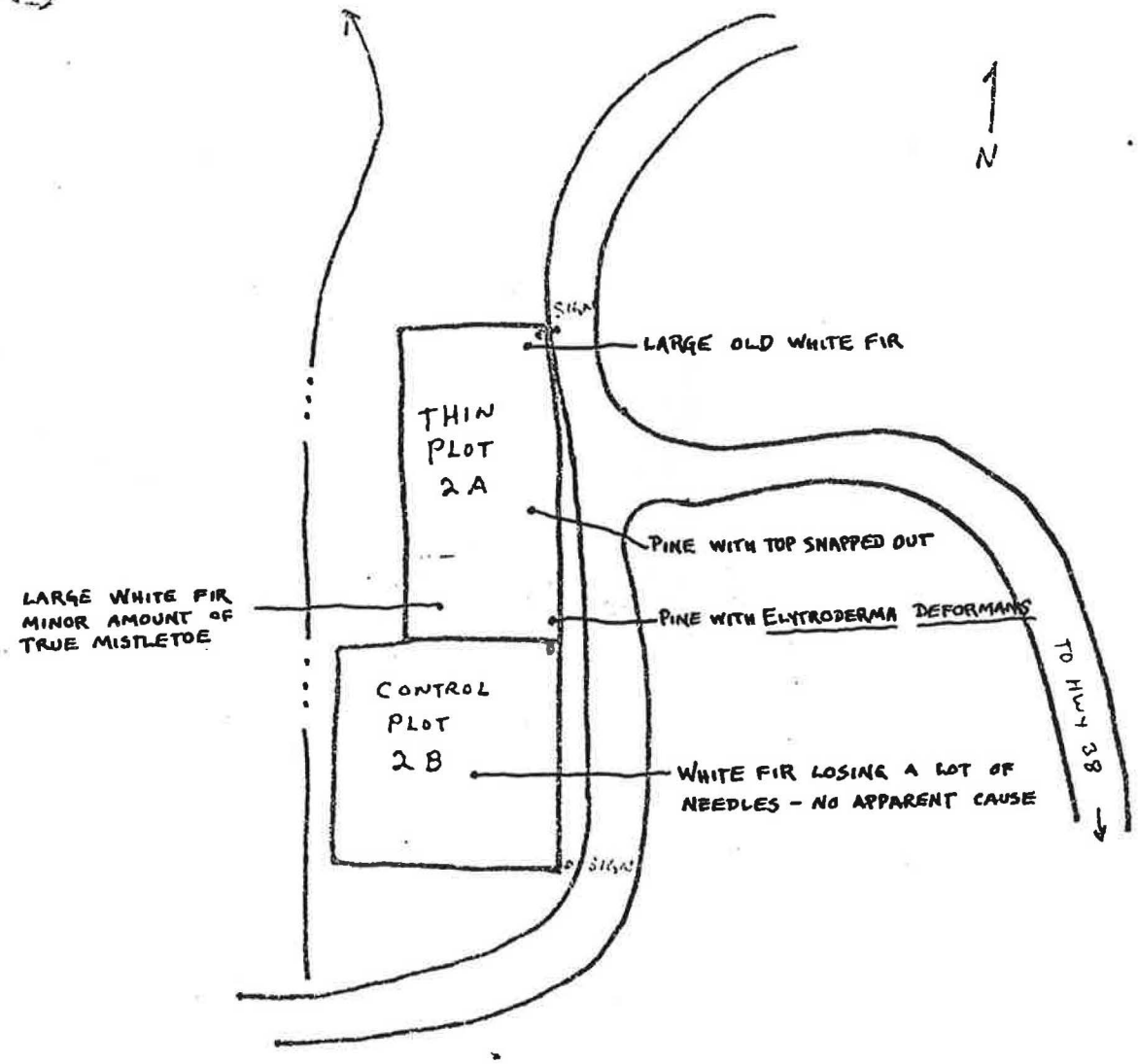
COUNCIL CAMP NOTES

1. Dead white fir - Scolytus ventralis and Melanophila drummondi.
2. Group of 3 dead pine (1 new, 2 old) Melanophila californica
3. Oak - possible hazard pruning
4. Elytroderma deformans witches' brooms in pine
5. 320 square feet basal area around white fir
6. 280 square feet basal area - pines
7. Juniper with sapsucker damage
8. Fairly dense stocking of pine saplings
9. Sierra redwood next to Fomes annosus center

LOBO-OSO CAMP NOTES

1. Small dead pine, Melanophila californica and dwarf mistletoe
2. Black oaks with true mistletoe
3. Black oaks with true mistletoe
4. Possibly hazardous pine
5. Dead pine hung up in tree
6. Dead white fir
7. Pine under attack by Jeffrey pine beetle
8. Black oaks with true mistletoe
9. Black oaks with true mistletoe
10. 220 square feet basal area - not much dwarf mistletoe
11. 320 square feet basal area - not much dwarf mistletoe
12. 260 square feet basal area
13. Pine with severe dwarf mistletoe brooms and hollow butt
14. Pine with dwarf mistletoe - possible prune
15. Stump with Fomes annosus conk north of "mistletoe tree" marker on trail
16. 260 square feet basal area
17. 320 square feet basal area
18. Dead pine sapling - severe dwarf mistletoe
19. Pine next to road - open dwarf mistletoe bole canker - Hazard?
20. 360 square feet basal area

MIXED CONIFER TYPE PLOT


N
SIGN
LARGE OLD WHITE FIR
THIN PLOT 2A
PINE WITH TOP SNAPPED OUT
LARGE WHITE FIR MINOR AMOUNT OF TRUE MISTLETOE
PINE WITH ELYTRODERMA DEFORMANS
TO HWY 28
CONTROL PLOT 2B
WHITE FIR LOSING A LOT OF NEEDLES - NO APPARENT CAUSE
SIGN

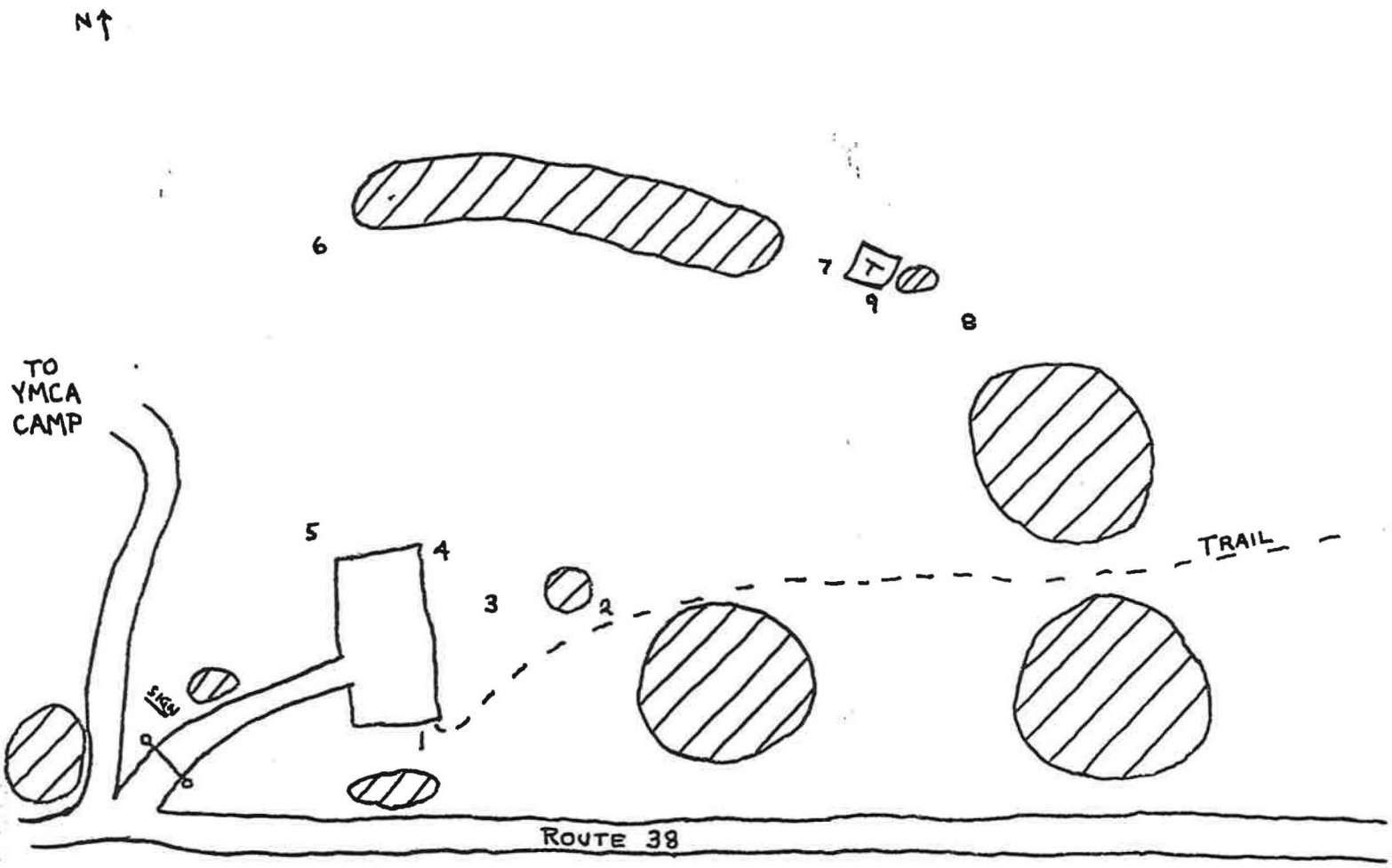
THIN PLOT = RUN S 170 ft, W 64 ft., N 170 ft, E 64 ft

CONTROL PLOT = RUN S 104 ft, W 104 ft, N 104 ft, E 104 ft

COUNCIL CAMP

FOMES ANNOSUS CENTER

1,2,3 NOTES



LOBO-OSO GROUP CAMPGROUND